CLAIMS

What is claimed is:

1. A virtual wire assembly comprising:

a substantially electrically-nonconductive substrate; and

a plurality of hermetic feedthroughs each comprising a first conductive region extending transversely through said substrate to form a conductive pathway with accessible surfaces at opposing ends thereof, wherein each said conductive pathway is electrically isolated from other said conductive pathways.

2. The assembly of claim 1, wherein said substrate is a semiconductor device.

3. The assembly of claim 1, wherein said first conductive regions each are comprised of an n-type or a p-type doped semiconductor material.

4. The assembly of claim 1, wherein said substrate is made of a material from the group consisting of silicon, germanium, and gallium arsenide.

5. The assembly of claim 1, further comprising electrical contacts positioned at the opposing ends of said conductive pathways.

6. The device of claim 5, wherein each of said electrical contacts is a terminal for electrically connecting to a wire.

7. The assembly of claim 6, wherein each of said terminals is made of at least one material from the group consisting of gold; platinum; a eutectic alloy; and an intrinsically electrically conductive polymeric material.

8. The assembly of claim 5, wherein each of said electrical contacts is a pad for electrically connecting to a wire.

9. The assembly of claim 5, wherein said electrical contact is configured to be attached to a wire.

10. The assembly of claim 9, wherein at least part of said wire is located in a groove in said first conductive region.

11. The assembly of claim 9, wherein at least part of said wire is located in a depression in said substrate.

12. The assembly of claim 11, wherein said electrical contact is secured in said depression using a cold weld.

13. The assembly of claim 11, wherein said electrical contact is secured in said depression using mechanical tension.

14. The assembly of claim 5, wherein said electrical contacts on at least one side of said substrate are in electrical communication with a ball grid array.

15. The assembly of claim 1, wherein said assembly is integrated into a casing defining a hermetic enclosure, wherein said hermetic enclosure contains circuitry electrically connected to said accessible surface of at least one of said conductive pathways, and wherein said accessible surface of each of said at least one conductive pathway is configured to be connected to an electrode lead.

16. The assembly of claim 17, wherein said substrate is attached to said casing on one side and attached to a casing extension on an opposite side, and wherein said casing and casing extension are joined together.

17. The assembly of claim 1, wherein said device further comprises an additional substrate having a plurality of second conductive regions, wherein said additional substrate is adjacent to said substrate such that said second conductive regions being substantially aligned with said first conductive regions.

18. A cochlear prosthesis comprising:

an external control unit that determines a pattern of electrical stimulation; and

an implanted stimulator unit operationally coupled to said control unit and comprising circuitry housed in a hermetic enclosure comprising a casing and a virtual wire assembly hermetically sealed within an aperture of said casing and having hermetic feedthroughs through which electrical stimulation channels are routed to provide electrical stimulation of auditory nerve cells.

19. The cochlear prosthesis of claim 18, wherein said virtual wire assembly comprises:

a substantially electrically-nonconductive substrate hermetically sealed within an aperture of said casing; and

said hermetic feedthroughs, wherein said hermetic feedthroughs each comprise a conductive region extending transversely through said substrate to form a conductive pathway with accessible surfaces at opposing ends thereof, wherein each said conductive pathway is electrically isolated from other said conductive pathways.

20. The cochlear prosthesis of claim 19, wherein said substrate is a semiconductor device.

21. The cochlear prosthesis claim 19, wherein said conductive regions each are comprised of an n-type or a p-type doped semiconductor material.

22. The cochlear prosthesis of claim 21, wherein said substrate is made of a material from the group consisting of silicon, germanium, and gallium arsenide.

23. The cochlear prosthesis of claim 19, wherein said virtual wire assembly further comprises electrical contacts disposed at opposing ends of said conductive regions.

24. The cochlear prosthesis of claim 23, wherein each of said electrical contacts is a terminal for electrically connecting to a wire.

25. The cochlear prosthesis of claim 24, wherein each of said terminals is made of at least one material from the group consisting of gold; platinum; a eutectic alloy; and an intrinsically electrically conductive polymeric material.

26. The cochlear prosthesis of claim 24, wherein said electrical contact is configured to be attached to a wire.

27. A method comprising:

providing a substantially electrically-nonconductive substrate; and

forming through said substrate a plurality of permanent hermetic feedthroughs each comprising a conductive region extending transversely through said substrate to form a conductive pathway with accessible surfaces at opposing ends thereof, wherein each said conductive pathway is electrically isolated from other said conductive pathways.

28. The method of claim 27, wherein providing said substrate comprises providing a semiconductor device, and wherein forming said hermetic feedthroughs through said substrate comprises doping said substrate to form n-type or p-type doped regions extending transversely through said substrate.

29. An implantable medical device comprising:

circuitry; and

a hermetic enclosure in which said circuitry is housed, said hermetic enclosure comprising: a casing with an aperture; and a virtual wire assembly hermetically sealed within said aperture of said casing, and having hermetic feedthroughs through which electrical signals can be routed.

30. The implantable medical device of claim 29, wherein said virtual wire assembly comprises:

a substantially electrically-nonconductive substrate hermetically sealed within an aperture of said casing; and

said hermetic feedthroughs, wherein said hermetic feedthroughs each comprise a conductive region extending transversely through said substrate to form a conductive pathway with accessible surfaces at opposing ends thereof, wherein each said conductive pathway is electrically isolated from other said conductive pathways.

31. The implantable medical device of claim 30, wherein said substantially electrically-nonconductive substrate is a semiconductor device.

32. The implantable medical device claim 30, wherein said conductive regions each comprise of an n-type or a p-type doped semiconductor material.